State—only two, that is, who can be assured that their schemes will not be mutilated by a non-scientific officer before going through the permanent Secretary to the appropriate Minister. The semi-official apology for this remarkable state of affairs is somewhat disingenuous. It is urged that the administrative machine is so complex that only those with long experience are competent to work it. If this be the true explanation of the subordination of the man of science to the lay official, it is high time the machinery of our Government Departments was overhauled. Ministers responsible for scientific Departments should realise that there is a growing class-consciousness among the younger men of science, and real resentment felt against the intrusion of lay officials into their proper sphere of activities. Such intrusion means duplication of work. It is worthy of note that in one Department where the lay element has been subordinated to the scientific staff a pre-war staff of more than a hundred has been reduced to eighty-two, although the work of the Department has greatly increased in the meantime.

The present system presents yet a further fault which must be remedied. The administrative head of a Department, the lay official, has authority to select the heads of scientific Departments under his immediate control. Being without the necessary qualification to judge of the scientific experience of a scientific worker, it follows that he must, to a large extent, rely upon the judgment of the retiring officer or of other scientific workers of his own choosing. In neither case does it follow that the best man available is chosen. We suggest that some machinery should be put into motion whereby the State could be reasonably assured of the high calibre of its scientific officers. Their selection might, for example, be entrusted to *ad hoc* committees of scientific experts appointed by outside scientific bodies at the request of the Government.

An inter-departmental comparison of the grading and salary scales of scientific workers in the Civil Service would reveal glaring anomalies, but it would occupy too much space in Nature. In no case do the status, pay, and prospects of promotion of scientific workers compare favourably with those which obtain in the higher clerical grades. Leaving out of consideration the conditions of service of medical men, the scheme lately adopted for scientific workers in the Fisheries Division of the Ministry of Agriculture and Fisheries is the most favourable in the Service. A comparison between this scheme and that in force for the higher clerical grades is given below:—

		Higher Division Clerks. (Administrative Class.)	Salary. £ £		Scientific Workers.	Salary. £ £
Grade	I.	1 post	1000–1200	...	1 post	1000
,,	II.	2 posts	700– 900	...	2 posts	650–750
,,	III.	4 ,,	500– 700	...	5 ,,	450–650
,,	IV.	4 ,,	200– 500	..	13 ,,	200–450

(All the above posts carry with them Civil Service bonuses in force.)

Such disparities of pay and prospects must react unfavourably against the recruitment of the best scientific workers to the ranks of Government officers. The best men will be attracted to the administrative class and be lost to science. Last year the Civil Service National Whitley Council published a report on the organisation of the Civil Service in which a comprehensive scheme was put forward for the clerical classes. After considerable delay a technical committee of the same council has been entrusted with the task of preparing a scheme for the scientific and technical classes. In the meantime the issue has been prejudicially affected by the varying schemes put forward by different Departments. There is no apparent reason for the inordinate delay in setting up the technical committee. It would have been more satisfactory to deal with all classes of Civil Servants in one report, like that on the United States Civil Service described in last week's issue of Nature.

A Great Giver.

Autobiography of Andrew Carnegie. Pp. xii + 385. (London: Constable and Co., Ltd., 1920.) 25*s*. net.

THE life-histories of remarkable men always have interest and value. Few are more fascinating than that of Andrew Carnegie, who began his business career as a telegraph messenger boy at two and a half dollars a week, and step by step, through many trials and triumphs, became the great steel-master, built up a colossal industry, amassed an enormous fortune, and then deliberately and systematically gave away the whole of it for the enlightenment and betterment of mankind. No doubt the element of chance has some part in such great success as that of Carnegie. But it is only a subordinate part. This autobiography enables us to see clearly enough that it was "character" inborn and nurtured by parents—sturdy and high-principled, though brought by the vicissitudes of business to great poverty, even to actual hunger—which determined Carnegie's career. Character made him courageously and honestly avail himself of the opportunities which "chance" placed to his hand.

Andrew Carnegie's childhood was influenced, as he tells us, by his birthplace, Dumfermline, the burial-place of King Robert the Bruce, with its abbey-church, palace, and glen—"perhaps the most radical town in the kingdom." From his uncles Bailie Morrison and George Lauder he learned much of Wallace, Bruce, and Burns, and he avows "there was then and there created in me a vein of Scottish prejudice or patriotism which will cease to exist only with life." He always kept Burns's philosophy of life before him, and as a schoolboy, when tempted to do a weak or selfish thing, would ask himself: "What would Wallace have done?" and braced himself to the braver course. His father's occupation as a hand-weaver having been superseded by the competition of large factories, the family—father, mother, and two sons, Andrew, aged twelve, and Thomas, aged four—emigrated to Pittsburg (Allegheny City), in the United States, where they had friends and hard-working relatives.

In the autobiography now published Andrew Carnegie tells his own story, not as one posturing before the public, but as in the midst of his own people and friends, tried and true, to whom he can speak with the utmost freedom. It is impossible to epitomise such a narrative. Its charm lies in the record of friendships and in personal touches, in the statement of guiding faith and principle, and of the worldly wisdom of a generous and worthy spirit which accompanies the detailed story of the steps by which the author rose. From being a messenger boy he became a telegraph operator, then a divisional superintendent of the Pennsylvania Railroad. He invested his first savings in the building of sleeping-cars and went on to the organising of rail-making and locomotive works and the formation of a company to build iron bridges, for which he also started the making of pig-iron. And so we come, in 1868, when Carnegie was thirty-three years old, to his great contracts in bridge-building and his negotiations with the bankers of New York and London, his ready command of capital, and the final concentration of all his energies upon the introduction into Pittsburg of the Bessemer steel process and the organisation of the Carnegie Steel Co.

In December, 1868, Carnegie wrote a memorandum which has great interest to-day. It is dated from the St. Nicholas Hotel, New York. He writes:

"Thirty-three and an income of 50,000 dollars per annum. By this time two years I can so arrange all my business as to secure at least 50,000 dollars per annum. Beyond this never earn—make no effort to increase fortune, but spend the surplus each year for benevolent purposes. Settle in Oxford and get a thorough education, making the acquaintance of literary men. . . . Settle in London. . . . Man must have an idol—the amassing of wealth is one of the worst species of idolatry. . . . I will resign business at thirty-five, but during the ensuing two years I wish to spend the afternoons in receiving instruction and in reading systematically."

Happily (or perhaps unhappily) for him, he did not carry out this programme. For another thirty-two years he was the head of the great business which grew and flourished marvellously in his hands. During that period he had more leisure—he travelled round the world, he spent summer holidays in Great Britain, and made the close friendship of such men as Matthew Arnold, Herbert Spencer, and many others prominent in literature or politics. In 1886, when he was fifty-one, both his mother and his brother died, and in the following year he married Miss Whitfield, of whom he writes (twenty years later) in 1906: "I cannot imagine myself going through these twenty years without her. Nor can I endure the thought of living after her."

Mr. Carnegie tells us in this autobiography that in 1901 the profits of his firm had reached forty millions of dollars per annum, and that seventy millions might have been earned in the year when he and his partners were informed by Mr. Pierpont Morgan, the banker, that if they wished to retire from business he thought he could arrange it. The Carnegie Steel Co. was bought by Mr. Morgan at the price which both he and Carnegie considered fair. We are not told in this book exactly what it was, but it was probably somewhere about one hundred and fifty million pounds, of which a smaller part went to Mr. Schwab and his partners, and the rest to Carnegie.

Andrew Carnegie had found great pleasure in giving pecuniary help to various public purposes during his fifty and more years of money-making. He now, at the age of sixty-six, set to work deliberately to give away his vast fortune (after amply providing for his wife and daughter) in such a way as to make it a source of betterment to his fellow-men. The present writer knew him at this period, and visited him at his place in Scotland, Skibo Castle. He was a kindly and unselfish host, taking a real pleasure in literature, and enjoying both golf and salmon-fishing. He was devoted to church music, and kept an accomplished musician to play the fine organ built in the hall of Skibo. He knew nothing of pictures or of science. There is no doubt that he devoted an immense amount of trouble and consideration to devising methods of bestowing his endowments which should be really beneficial and not either futile or pauperising.

There are many people who, through ignorance and a low estimate of human motive, sneer at Carnegie's "free libraries," and foolishly regard his generous gifts as mere vanity and self-advertisement. Those who knew him, and, indeed, all who examine the record of his various benefactions, are led to a different conclusion—namely, that he carried out in his later years the generous purpose of his early life, and aimed at employing his wealth for the good of the community, with some kindly partiality towards the men who had worked in his employ and those associated with his native place. We cannot give here the complete list and amounts of his benefactions, but to the Carnegie Corporation of New York, "to promote the advancement and diffusion of knowledge by aiding institutions of higher learning and scientific research," he gave 25 million pounds, and it is not yet known what further sum it may receive as his residuary legatee. To the relief fund for men in his mills he gave one million pounds; to establish, in the United States, a pension fund for aged university professors he gave three million pounds, and a million pounds to pay the fees of poor students in Scotch universities; and another million to improve the universities. To nearly three thousand towns (many in Great Britain) Carnegie gave library buildings at a cost of fifteen million pounds. To establish the beautiful museum, library, and picture gallery at Pittsburg, he paid more than five million pounds. Including his hero fund, his Peace Palace at The Hague, and many minor gifts, the Carnegie benefactions, all told, amount, according to the authoritative statement of the editor of this autobiography, to something more than seventy million pounds sterling (350 million dollars)—"a huge sum," as the editor remarks, "to have been brought together and then distributed (in his lifetime) by one man."

The gift in making which Mr. Carnegie tells us he had a greater pleasure than he derived from any other was that of Pittencrieff Park and Glen, together with King Malcolm's tower and St. Margaret's shrine—the paradise of his childhood—presented by him to his native city, Dumfermline. The final chapter of the book tells of Carnegie's visit to the Emperor William, and the bitter disappointment of the old man when, in 1914, he found his faith in the Emperor as a man of peace misplaced.

The bare facts which we have mentioned in this notice of Andrew Carnegie's autobiography are transformed in their narration by the man himself into a most engaging personal story, replete with revelations of worldly wisdom, generous and upright character, and tender feeling. It is, indeed, well worth reading. One of America's greatest men—Elihu Root—in 1920 said of Carnegie at a meeting held in memory of his life and work:

> "He belonged to that great race of nation-builders who have made the development of America the wonder of the world. He was the kindliest man I ever knew. Wealth had brought him no hardening of the heart, nor made him forget the dreams of his youth. Kindly, affectionate, charitable in his judgments, unrestrained in his sympathies, noble in his impulses, I wish that all the people who think of him as a rich man giving away money he did not need could know of the hundreds of kindly things he did unknown to the world."

E. RAY LANKESTER.

Mathematical Papers of Huygens.

Œuvres Complètes de Christiaan Huygens. Tome Quatorzième. Calcul des Probabilités. Travaux de Mathématiques Pures; 1655–1666. Pp. v+557. (La Haye: Martinus Nijhoff. 1920.)

THIS volume contains Huygens's celebrated essay, "De ratiociniis in ludo aleæ," and various minor mathematical papers of his earlier years. The theory of probability was founded in 1654, when a gambler who was interested in mathematics proposed to Pascal some problems connected with games of chance. Pascal corresponded with Fermat about one of these, the "problem of points," to which he attached the greatest importance. Two players of equal skill want each a certain number of points to win; if they stop their game before it is finished, how should the stakes be divided between them? Pascal and Fermat came to the same result, but gave different proofs. In the following year Huygens was in Paris and heard of this, but he neither met Pascal or Fermat, nor received any information as to their methods.

On his return home he lost no time in preparing his treatise on games of chance, which was published in Latin in 1657 as an Appendix to van Schooten's "Mathematical Exercises," and three years later in the original Dutch. The treatise contains fourteen propositions. The first three define the expectation of a player who has p chances of gaining a sum a and q chances of gaining b, as $(pa+qb)/(p+q)$. The six next pro-